CERTIFICATE

By Authority Of
THE UNITED STATES OF AMERICA
Legally Binding Document

By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly INCORPORATED BY REFERENCE and shall be considered legally binding upon all citizens and residents of the United States of America. ***HEED THIS NOTICE***: Criminal penalties may apply for noncompliance.

This Document Posted By
Public.Resource.Org, Inc.,
a California Nonprofit
Organization.

Not Affiliated Or
Authorized by ASTM
or by the United States
Government

Document Name: ASTM D1535: Specifying Color by the Munsell System

CFR Section(s): 16 CFR 1402

Standards Body: American Society for Testing and Materials

Official Incorporator:
THE EXECUTIVE DIRECTOR
OFFICE OF THE FEDERAL REGISTER
WASHINGTON, D.C.

Designation: D 1535 - 68

Standard Method of
SPECIFYING COLOR BY THE MUNSELL SYSTEM[1]

This Standard is issued under the fixed designation D 1535; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

NOTE—Editorial correction was made in Table 1 in January 1969.

1. Scope

1.1 This method provides a means for specifying the colors of objects in terms of the Munsell color system, a system based on the color-perception attributes, hue, lightness, and saturation. The method is limited to opaque objects, such as painted surfaces, viewed in daylight by an observer having normal color vision. This method provides a simple alternative to the more precise and more complex method of color specification based on spectrophotometry and the CIE system (**1**).[2] Provision is made for conversion of CIE data to Munsell notation.

2. Definitions

2.1 *surface-color-perception solid*—a cylindrical color solid based on the three perceptual attributes, hue, lightness and saturation as shown in Fig. 1. This solid forms the basis of Munsell notation. The central, vertical axis dimension of the surface-color-perception solid represents the grays, extending from black at the bottom to white at the top. The lightness of a color perceived as chromatic (nongray) is represented in the color solid by distance above the base plane and is measured by the gray to which it is equivalent. Hue is represented by the angular position about this axis; saturation is represented by perpendicular distance from the axis. If the observer has normal color vision, is adapted to daylight, and views the specimen illuminated by CIE Source C or D_{6500} on a middle gray to white background, the Munsell value of the specimen correlates well with the observer's perception of the lightness of its color. Under the same conditions, the Munsell hue of the specimen correlates well with the observer's perception of its hue, and the Munsell chroma with his perception of its saturation.

2.2 *Munsell color notation*—a system of letters or numbers, or both, by which the color of any opaque object may be specified with respect to Munsell hue, H, Munsell value, V, and Munsell chroma, C, written in the form, $H\ V/C$. The Munsell color notation of a specimen is obtained by visual comparison with the Munsell hue, value, and chroma scales of the Munsell Book of Color, or determined from its daylight reflectance, Y, and chromaticity coordinates, x, y, in the CIE system by reference to the scales of the ideal Munsell system (**2**).

NOTE 1—Prior to 1968, this standard made a distinction between the visually obtained Munsell Book Notation and the ideal scale color notation called Munsell Renotation. This distinction need no longer be made for all color chips made for the Munsell Book of Color now conform to the ideal scale notation.

2.3 *hue*—the attribute of color perception by means of which an object is judged to be red, yellow, green, blue, purple, or intermediate between some adjacent pair of these.

2.3.1 *Munsell hue*—the attribute of a specimen, in Munsell terms, which correlates with the perceived hue of the specimen. Two designation systems for Munsell hue are shown in Fig. 2, a letter-number system, and an all-number system. The letter-number system is preferred.

---

[1] This method is under the jurisdiction of ASTM Committee D-1 on Paint, Varnish, Lacquer, and Related Products.

Current edition effective Sept. 13, 1968. Originally issued 1958. Replaces D 1535 - 62.

[2] The boldface numbers in parentheses refer to the references listed at the end of this method.

2.4 *lightness*—the attribute of color perception by means of which an object is judged to reflect more or less light than another object.

2.4.1 *Munsell value* —The daylight reflectance of a specimen expressed on a scale extending from 0 for ideal black to 10 for ideal white by steps of approximately equal visual importance. Value notations are written *V*/. Achromatic or neutral colors are designated *N* followed by the value notation, thus: *N* 5.0/. Technically, neutral *N* indicates colors with 0.0 chroma; but because this would not allow the gray series to be easily identified and segregated, the near-neutrals (usually considered as chromas under 0.5) are sometimes indicated as *N*, and the chroma, accompanied by the nearest of the principal hue names, is placed in parentheses after the solidus (/) which follows the value number, as for example *N* 8.7/(*Y* 0.3), *N* 6.0/(*B* 0.1).

2.5 *Saturation*—the attribute of color perception that expresses the degree of departure from the gray of the same lightness. All grays have zero saturation.

2.5.1 *Munsell chroma*—the departure of a color from a gray having the same Munsell value, expressed on a scale extending from 0, by steps of approximately equal visual importance, to about 20 for the strongest-colored specimens producible. Chroma notations are written: /*C*, thus chroma 5 is written: /5.

3. Apparatus

3.1 *Munsell Book of Color*, matte or glossy edition.[3]

3.2 *Gray Masks* with rectangular openings of Munsell book chip size.

3.3 *Daylight* illuminating equipment or equivalent.[4]

4. Preparation of Test Specimens

4.1 This method does not cover the preparation of test specimens. If the preparation of test specimens is required in conjunction with this method, a mutually agreed upon procedure shall be established.

5. Munsell Color Notation by Visual Means

5.1 *Lighting and Viewing Conditions*—Place the specimen on a neutral background (middle gray to white), and illuminate it with natural or artificial daylight. The specimen should be viewed by an observer with normal color vision. Select a window in which the sun is not shining. A north window is usually used in the northern hemisphere. Place a table by the window so that light reaches the table top from the observer's side, chiefly from the sky, and at angles centering on 45 deg from the horizontal. Place a canopy of black cloth above the working surface to prevent errors caused by reflections of light from the ceiling or room objects in the surface of the specimen. View the specimen along a direction just far enough from the perpendicular to avoid reflection of the observer's forehead. Although 45-deg illumination and perpendicular viewing are recommended by the CIE, converse conditions will give results equivalent to the recommended method if a black cloth is hung opposite the observer.

5.2 *Procedure*—If both matte and glossy editions of the Munsell Book of Color are available, use the edition the gloss of which is closer to that of the specimen. Select the two adjacent Munsell constant-hue charts or chips between which the hue of the specimen lies. Place one on each side of the specimen. Cover the specimen and the charts with the gray masks so that the specimen and one chip from each chart can be seen. Move masks from chip to chip in order to find the chips most closely matching the specimen. The glossy charts have removable chips. When using these charts, the appropriate chips should be removed and placed immediately adjacent to the specimen. Estimate, in order, the value, chroma, and hue by interpolation or extrapolation of the chip designations as described in 5.2.1 to 5.2.3. Interchange positions of the charts, repeat the estimations, and average the results.

5.2.1 *Value*—Find the chips between which the value of the specimen lies. Estimate the value of the specimen to the nearest tenth of the one-value-step interval between adjacent value levels. Record the estimated value in front of the solidus, for example 4.2/.

---

[3] Available from the Munsell Color Co., 2441 N. Calvert St., Baltimore, Md. 21218.

[4] See ASTM Method D 1729, Visual Evaluation of Color Differences of Opaque Materials, which appears in the *Annual Book of ASTM Standards*, Parts 21 and 30.

5.2.2 *Chroma*—Move the masks so as to present successive colors of the same Munsell hue and value but of different chroma, and, by interpolation or extrapolation, determine the Munsell chroma of the color. Pay chief attention to the Munsell chips having values nearest that of the specimen, and secondary attention to those next nearest. Although all Munsell chips of the same chroma notation are intended to yield color perceptions having the same saturation, a slightly different estimate of chroma may be obtained by comparison with the chips of the next value. In such a case, average the estimated chromas. Note that there are usually two chroma steps between adjacent columns of a chart. Estimate the chroma to the nearest fifth of the 2-chroma interval, and record the estimated chroma after the value estimate and solidus, for example 4.2/6.4.

5.2.3 *Hue*—Estimate the hue of the specimen by interpolation between the chips of the nearest Munsell value and chroma in the selected hue charts. Estimate to the nearest fifth of the 2.5-hue steps between adjacent hue charts. Record the hue estimate in front of the value-chroma estimate and separated from it by a space, for example 4.5 *R* 4.2/6.4. If the value and chroma of the specimen do not correspond closely to those of any chip, repeat the interpolation of hue with the next closest pair of chips and record the average.

6. Munsell Color Notation from CIE Data

6.1 *Procedure*—Convert the luminous reflectance, Y and the chromaticity coordinates, x, y, of the specimen to Munsell color notation by referring to Table 1 and Figs. 3 to 16.[5]

6.2 Find in Table 1 of the value, V, equivalent to the luminous reflectance, Y. Use Figs. 3 to 16 to estimate hue and chroma for value levels on either side of the required value. Interpolate to adjust the hue and chroma to the required value level, assuming linearity between value levels. When the required value level differs from that of the nearest value level diagram by 0.05/or less, interpolation is not necessary. In such cases, use the hue and chroma derived from the nearest value level diagram.

NOTE 2: *Example*—Obtain the Munsell notation for: $Y = 46.02, x = 0.500, y = 0.454$.

(*1*) From Table 1, $Y = 46.02$ is equivalent to Munsell value 7.20.

(*2*) Find hue and chroma by interpolation between value levels 7 and 8 of Figs. 11 and 13. On Fig. 13, for $x = 0.500$, $y = 0.454$, the Munsell hue is just redder than 10.0*YR*. Since the difference is less than 0.25 hue step, read it as 10.0*YR*. The chroma lies between 14 and 16, estimated at 14.6. On Fig. 11, for $x = 0.500$, $y = 0.454$, the hue lies at 10.0*YR* and the chroma between 12 and 14, estimated at 13.1.

(*3*) Since value 7.2 is two tenths of the difference between values 7.0 and 8.0, the interpolated hue will be that of value 7 plus 0.2 times the difference between the hues read from Figs. 11 and 13. Since the hue on Fig. 13 is 10.0*YR*, and on Fig. 11 is 10.0*YR*, no interpolation is required. The interpolated chroma will be that read at value 7 plus 0.2 times the difference between the chromas read from Figs. 11 and 13. Since the chroma on Fig. 13 is 14.6, and on Fig. 11 is 13.1, the interpolated chroma will be $13.1 + [0.2(14.6 - 13.1)] = 13.4$.

(*4*) The complete Munsell color notation is 10.0*YR* 7.2/13.4.

6.3 *Munsell Notation of Dark Colors*—Determine color notations for Munsell values less than 1 by referring to the published extension of the Munsell system to very dark colors (**3**).

7. Report

7.1 Report the notation in the Munsell color system, specifying whether the notation was obtained visually from matte or glossy book, or by conversion of colorimetric data.

8. Precision

8.1 The estimated precision within which a color notation can be determined by visual comparison is 0.5 hue step, 0.1 value step, and 0.4 chroma step.

---

[5] Figures 8, 10, 12, 14, and 16 are enlargements of the low-chroma areas of Figs. 7, 9, 11, 13, and 15. Large-scale diagrams of Figs. 3 through 16 are available from the Munsell Color Co., 2441 N. Calvert St., Baltimore, Md. 21218.

REFERENCES

(1) ASTM Recommended Practice E 308, for Spectrophotometry and Description of Color in the CIE 1931 System, which appears in this publication.

(2) "Final Report of the OSA Subcommittee on the Spacing of the Munsell Colors," *Journal*, Optical Soc. Am., JOSAA, Vol 33, 1943, p. 385.

(3) "Extension of the Munsell Renotation System to Very Dark Colors," *Journal*, Optical Soc. Am., JOSAA, Vol 46, 1956, p. 281.

(4) Nimeroff, I., "Colorimetry," *Monograph 104*, Nat. Bureau Standards, NBS, January 1968.

(5) Prepared for D. Nickerson, U. S. Dept. of Agriculture.

TABLE 1 Luminous Reflectance, *Y*, in Percent Relative to MgO, Equivalent to Munsell Renotation Value, *V* (2)

V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y
10.00	102.57																		
9.99	102.30	8.99	78.45	7.99	58.92	6.99	42.92	5.99	29.94	4.99	19.68	3.99	11.935	2.99	6.511	1.99	3.100	0.99	1.196
8	102.04	8	78.23	8	58.74	8	42.77	8	29.82	8	19.59	8	11.870	8	6.468	8	3.075	8	1.182
7	101.78	7	78.02	7	58.57	7	42.63	7	29.71	7	19.50	7	11.805	7	6.425	7	3.050	7	1.168
6	101.52	6	77.80	6	58.39	6	42.49	6	29.59	6	19.41	6	11.740	6	6.382	6	3.025	6	1.154
5	101.25	5	77.59	5	58.22	5	42.34	5	29.48	5	19.32	5	11.675	5	6.339	5	3.000	5	1.141
9.94	100.99	8.94	77.38	7.94	58.04	6.94	42.20	5.94	29.36	4.94	19.23	3.94	11.611	2.94	6.296	1.94	2.975	0.94	1.128
3	100.73	3	77.16	3	57.87	3	42.06	3	29.25	3	19.14	3	11.547	3	6.254	3	2.950	3	1.114
2	100.47	2	76.95	2	57.69	2	41.92	2	29.13	2	19.06	2	11.483	2	6.212	2	2.925	2	1.101
1	100.21	1	76.74	1	57.52	1	41.77	1	29.02	1	18.97	1	11.419	1	6.170	1	2.901	1	1.087
0	99.95	0	76.53	0	57.35	0	41.63	0	28.90	0	18.88	0	11.356	0	6.128	0	2.877	0	1.074
9.89	99.69	8.89	76.32	7.89	57.17	6.89	41.49	5.89	28.79	4.89	18.79	3.89	11.292	2.89	6.086	1.89	2.853	0.89	1.060
8	99.44	8	76.11	8	57.00	8	41.35	8	28.68	8	18.70	8	11.229	8	6.045	8	2.829	8	1.047
7	99.18	7	75.90	7	56.83	7	41.21	7	28.57	7	18.62	7	11.167	7	6.003	7	2.805	7	1.034
6	98.92	6	75.69	6	56.66	6	41.07	6	28.45	6	18.53	6	11.104	6	5.962	6	2.781	6	1.021
5	98.66	5	75.48	5	56.48	5	40.93	5	28.34	5	18.44	5	11.042	5	5.921	5	2.758	5	1.008
9.84	98.41	8.84	75.27	7.84	56.31	6.84	40.79	5.84	28.23	4.84	18.36	3.84	10.980	2.84	5.881	1.84	2.735	0.84	0.995
3	98.15	3	75.06	3	56.14	3	04.65	3	28.12	3	18.27	3	10.918	3	5.841	3	2.712	3	.982
2	97.90	2	74.85	2	55.97	2	40.51	2	28.01	2	18.19	2	10.856	2	5.800	2	2.688	2	.969
1	97.64	1	74.64	1	55.80	1	40.37	1	27.90	1	18.10	1	10.795	1	5.760	1	2.665	1	.956
0	97.39	0	74.44	0	55.63	0	40.23	0	27.78	0	18.02	0	10.734	0	5.720	0	2.642	0	.943
9.79	97.14	8.79	74.23	7.79	55.46	6.79	40.09	5.79	27.67	4.79	17.93	3.79	10.673	2.79	5.680	1.79	2.620	0.79	.931
8	96.88	8	74.02	8	55.29	8	39.95	8	27.56	8	17.85	8	10.612	8	5.641	8	2.598	8	.918
7	96.63	7	73.82	7	55.12	7	39.82	7	27.45	7	17.76	7	10.551	7	5.602	7	2.575	7	.906
6	96.38	6	73.61	6	54.95	6	39.68	6	27.34	6	17.68	6	10.491	6	5.563	6	2.553	6	.893
5	96.13	5	73.40	5	54.78	5	39.54	5	27.23	5	17.60	5	10.431	5	5.524	5	2.531	5	.881
9.74	95.88	8.74	73.20	7.74	54.62	6.74	39.40	5.74	27.12	4.74	17.51	3.74	10.371	2.74	5.485	1.74	2.509	0.74	.868
3	95.63	3	72.99	3	54.45	3	39.27	3	27.02	3	17.43	3	10.311	3	5.447	3	2.487	3	.856
2	95.38	2	72.79	2	54.28	2	39.13	2	26.91	2	17.34	2	10.252	2	5.408	2	2.465	2	.844
1	95.13	1	72.59	1	54.11	1	39.00	1	26.80	1	17.26	1	10.193	1	5.370	1	2.443	1	.832
0	94.88	0	72.38	0	53.94	0	38.86	0	26.69	0	17.18	0	10.134	0	5.332	0	2.422	0	.819
9.69	94.63	8.69	72.18	6.69	53.78	6.69	38.72	5.69	26.58	4.69	17.10	3.69	10.075	2.69	5.295	1.69	2.401	0.69	.807
8	94.38	8	71.98	8	53.61	8	38.59	8	26.48	8	17.02	8	10.017	8	5.257	8	2.380	8	.795
7	94.14	7	71.78	7	53.45	7	38.45	7	26.37	7	16.93	7	9.959	7	5.220	7	2.359	7	.783
6	93.89	6	71.57	6	53.28	6	38.32	6	26.26	6	16.85	6	9.901	6	5.183	6	2.338	6	.771
5	93.64	5	71.37	5	53.12	5	38.18	5	26.15	5	16.77	5	9.843	5	5.146	5	2.317	5	.759
9.64	93.40	8.64	71.17	7.64	52.95	6.64	38.05	5.64	26.05	4.64	16.69	3.64	9.785	2.64	5.109	1.64	2.296	0.64	.747
3	93.15	3	70.97	3	52.79	3	37.92	3	25.94	3	16.61	3	9.728	3	5.072	3	2.276	3	.735
2	92.91	2	70.77	2	52.62	2	37.78	2	25.84	2	16.53	2	9.671	2	5.036	2	2.256	2	.723
1	92.66	1	70.57	1	52.46	1	37.65	1	25.73	1	16.45	1	9.614	1	5.000	1	2.236	1	.711
0	92.42	0	70.37	0	52.30	0	37.52	0	25.62	0	16.37	0	9.557	0	4.964	0	2.216	0	.699
9.59	92.18	8.59	70.17	7.59	52.13	6.59	37.38	5.59	25.52	4.59	16.29	3.59	9.501	2.59	4.928	1.59	2.196	0.59	.687
8	91.93	8	69.97	8	51.97	8	37.25	8	25.41	8	16.21	8	9.445	8	4.892	8	2.176	8	.675
7	91.69	7	69.78	7	51.81	7	37.12	7	25.31	7	16.13	7	9.389	7	4.857	7	2.156	7	.663
6	91.45	6	69.58	6	51.64	6	36.99	6	25.20	6	16.05	6	9.333	6	4.822	6	2.136	6	.651
5	91.21	5	69.38	5	51.48	5	36.86	5	25.10	5	15.97	5	9.277	5	4.787	5	2.116	5	.640
9.54	90.97	8.54	69.18	7.54	51.32	6.54	36.72	5.54	25.00	4.54	15.89	3.54	9.222	2.54	4.752	1.54	2.097	0.54	.628
3	90.73	3	68.99	3	51.16	3	36.59	3	24.89	3	15.81	3	9.167	3	4.717	3	2.078	3	.617
2	90.49	2	68.79	2	51.00	2	36.46	2	24.79	2	15.74	2	9.112	2	4.682	2	2.059	2	.605
1	90.25	1	68.59	1	50.84	1	36.33	1	24.69	1	15.66	1	9.058	1	4.648	1	2.040	1	.593
0	90.01	0	68.40	0	50.68	0	36.20	0	24.58	0	15.57	0	9.003	0	4.614	0	2.021	0	.581

TABLE 1—*Continued*

V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y	V_Y	Y
9.49	89.77	8.49	68.20	7.49	50.52	6.49	36.07	5.49	24.48	4.49	15.49	3.49	8.949	2.49	4.580	1.49	2.002	0.49	0.570
8	89.53	8	68.01	8	50.36	8	35.94	8	24.38	8	15.42	8	8.895	8	4.546	8	1.983	8	.559
7	89.30	7	67.81	7	50.20	7	35.81	7	24.28	7	15.34	7	8.841	7	4.512	7	1.965	7	.547
6	89.06	6	67.62	6	50.04	6	35.68	6	24.17	6	15.26	6	8.787	6	4.479	6	1.947	6	.535
5	88.82	5	67.43	5	49.88	5	35.56	5	24.07	5	15.18	5	8.734	5	4.446	5	1.929	5	.524
9.44	88.59	8.44	67.23	7.44	49.72	6.44	35.43	5.44	23.97	4.44	15.11	3.44	8.681	2.44	4.413	1.44	1.910	0.44	.513
3	88.35	3	67.04	3	49.56	3	35.30	3	23.87	3	15.03	3	8.628	3	4.380	3	1.892	3	.501
2	88.12	2	66.85	2	49.41	2	35.17	2	23.77	2	14.96	2	8.575	2	4.347	2	1.874	2	.489
1	87.88	1	66.66	1	49.25	1	35.03	1	23.67	1	14.88	1	8.523	1	4.314	1	1.856	1	.478
0	87.65	0	66.46	0	49.09	0	34.92	0	23.57	0	14.81	0	8.471	0	4.282	0	1.838	0	.467
9.39	87.41	8.39	66.27	7.39	48.93	6.39	34.79	5.39	23.47	4.39	14.73	3.39	8.419	2.39	4.250	1.39	1.821	0.39	.455
8	87.18	8	66.08	8	48.78	8	34.66	8	23.37	8	14.66	8	8.367	8	4.218	8	1.803	8	.444
7	86.95	7	65.89	7	48.62	7	34.54	7	23.27	7	14.58	7	8.316	7	4.186	7	1.786	7	.432
6	86.72	6	65.70	6	48.47	6	34.41	6	23.17	6	14.51	6	8.264	6	4.154	6	1.769	6	.421
5	86.48	5	65.51	5	48.31	5	34.28	5	23.07	5	14.43	5	8.213	5	4.123	5	1.752	5	.409
9.34	86.25	8.34	65.32	7.34	48.16	6.34	34.16	5.34	22.97	4.34	14.36	3.34	8.162	2.34	4.092	1.34	1.735	0.34	.398
3	86.02	3	65.13	3	48.00	3	34.03	3	22.87	3	14.28	3	8.111	3	4.060	3	1.718	3	.386
2	85.79	2	64.94	2	47.85	2	33.91	2	22.78	2	14.21	2	8.060	2	4.029	2	1.701	2	.375
1	85.56	1	64.76	1	47.69	1	33.78	1	22.68	1	14.14	1	8.010	1	3.998	1	1.684	1	.363
0	85.33	0	64.57	0	47.54	0	33.66	0	22.58	0	14.07	0	7.960	0	3.968	0	1.667	0	.352
9.29	85.10	8.29	64.38	7.29	47.38	6.29	33.54	5.29	22.48	4.29	13.99	3.29	7.910	2.29	3.938	1.29	1.650	0.29	.341
8	84.88	8	64.19	8	47.23	8	33.41	8	22.38	8	13.92	8	7.860	8	3.907	8	1.634	8	.329
7	84.65	7	64.01	7	47.08	7	33.29	7	22.29	7	13.85	7	7.811	7	3.877	7	1.618	7	.318
6	84.42	6	63.82	6	46.92	6	33.16	6	22.19	6	13.78	6	7.762	6	3.847	6	1.601	6	.306
5	84.19	5	63.63	5	46.77	5	33.04	5	22.09	5	13.70	5	7.713	5	3.817	5	1.585	5	.295
9.24	83.97	8.24	63.45	7.24	46.62	6.24	32.92	5.24	22.00	4.24	13.63	3.24	7.664	2.24	3.787	1.24	1.569	0.24	.283
3	83.74	3	63.26	3	46.47	3	32.80	3	21.90	3	13.56	3	7.615	3	3.758	3	1.553	3	.272
2	83.52	2	63.08	2	46.32	2	32.67	2	21.81	2	13.49	2	7.567	2	3.729	2	1.537	2	.260
1	83.29	1	62.89	1	46.17	1	32.55	1	21.71	1	13.42	1	7.519	1	3.700	1	1.521	1	.248
0	83.07	0	62.71	0	46.02	0	32.43	0	21.62	0	13.35	0	7.471	0	3.671	0	1.506	0	.237
9.19	82.84	8.19	62.52	7.19	45.87	6.19	32.31	5.19	21.52	4.19	13.28	3.19	7.423	2.19	3.642	1.19	1.490	0.19	.225
8	82.62	8	62.34	8	45.72	8	32.19	8	21.43	8	13.21	8	7.375	8	3.613	8	1.475	8	.214
7	82.39	7	62.16	7	45.57	7	32.07	7	21.33	7	13.14	7	7.328	7	3.585	7	1.459	7	.202
6	82.17	6	61.98	6	45.42	6	31.95	6	21.24	6	13.07	6	7.281	6	3.557	6	1.444	6	.191
5	81.95	5	61.79	5	45.27	5	31.83	5	21.14	5	13.00	5	7.234	5	3.529	5	1.429	5	.179
9.14	81.73	8.14	61.61	7.14	45.12	6.14	31.71	5.14	21.05	4.14	12.93	3.14	7.187	2.14	3.501	1.14	1.413	0.14	.167
3	81.50	3	61.43	3	44.97	3	31.59	3	20.96	3	12.86	3	7.140	3	3.473	3	1.398	3	.155
2	81.28	2	61.25	2	44.82	2	31.47	2	20.86	2	12.80	2	7.094	2	3.445	2	1.383	2	.143
1	81.06	1	61.07	1	44.67	1	31.35	1	20.77	1	12.73	1	7.048	1	3.418	1	1.368	1	.131
0	80.84	0	60.88	0	44.52	0	31.23	0	20.68	0	12.66	0	7.002	0	3.391	0	1.354	0	.120
9.09	80.62	8.09	60.70	7.09	44.38	6.09	31.11	5.09	20.59	4.09	12.59	3.09	6.956	2.09	3.364	1.09	1.339	0.09	.108
8	80.40	8	60.52	8	44.23	8	30.99	8	20.49	8	12.52	8	6.911	8	3.337	8	1.324	8	.096
7	80.18	7	60.35	7	44.08	7	30.87	7	20.40	7	12.46	7	6.866	7	3.310	7	1.310	7	.084
6	79.97	6	60.17	6	43.94	6	30.75	6	20.31	6	12.39	6	6.821	6	3.283	6	1.295	6	.073
5	79.75	5	59.99	5	43.79	5	30.64	5	20.22	5	12.32	5	6.776	5	3.256	5	1.281	5	.061
9.04	79.53	8.04	59.81	7.04	43.64	6.04	30.52	5.04	20.13	4.04	12.26	3.04	6.731	2.04	3.230	1.04	1.267	0.04	.049
3	79.31	3	59.63	3	43.50	3	30.40	3	20.04	3	12.19	3	6.687	3	3.204	3	1.253	3	.036
2	79.10	2	59.45	2	43.35	2	30.28	2	19.95	2	12.12	2	6.643	2	3.178	2	1.238	2	.024
1	78.88	1	59.28	1	43.21	1	30.17	1	19.86	1	12.06	1	6.599	1	3.152	1	1.224	1	.012
0	78.66	0	59.10	0	43.06	0	30.05	0	19.77	0	12.00	0	6.555	0	3.126	0	1.210	0	.000

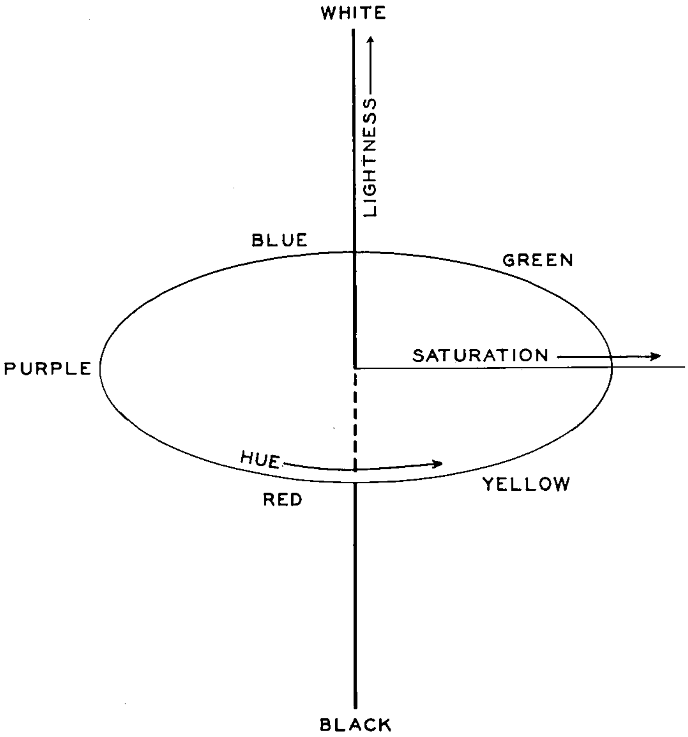

FIG. 1 Dimensions of the Surface-Color-Perception Solid (4).

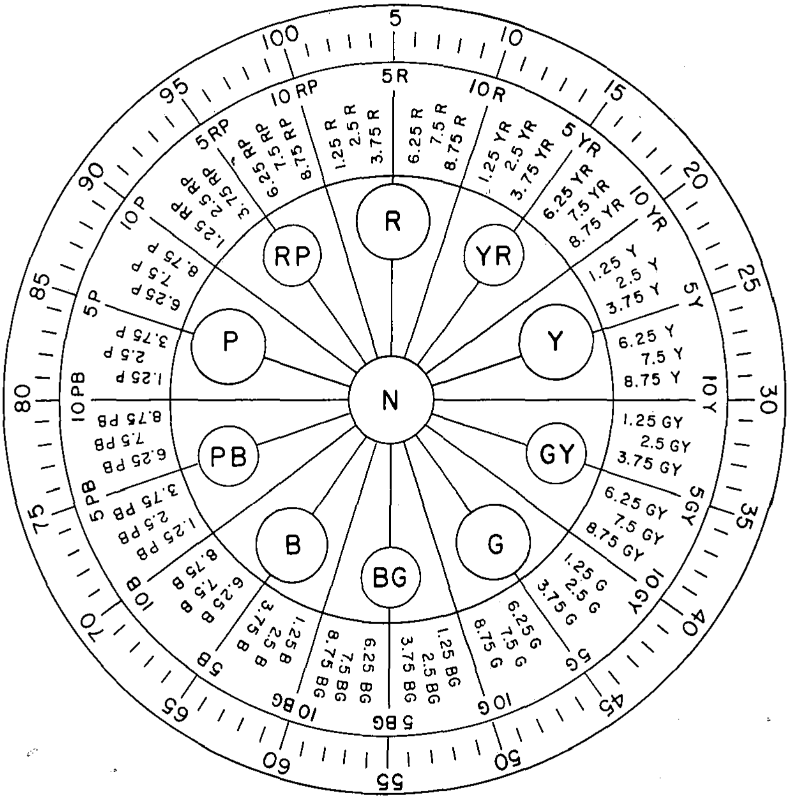

FIG. 2 Designation Systems for Munsell Hue.

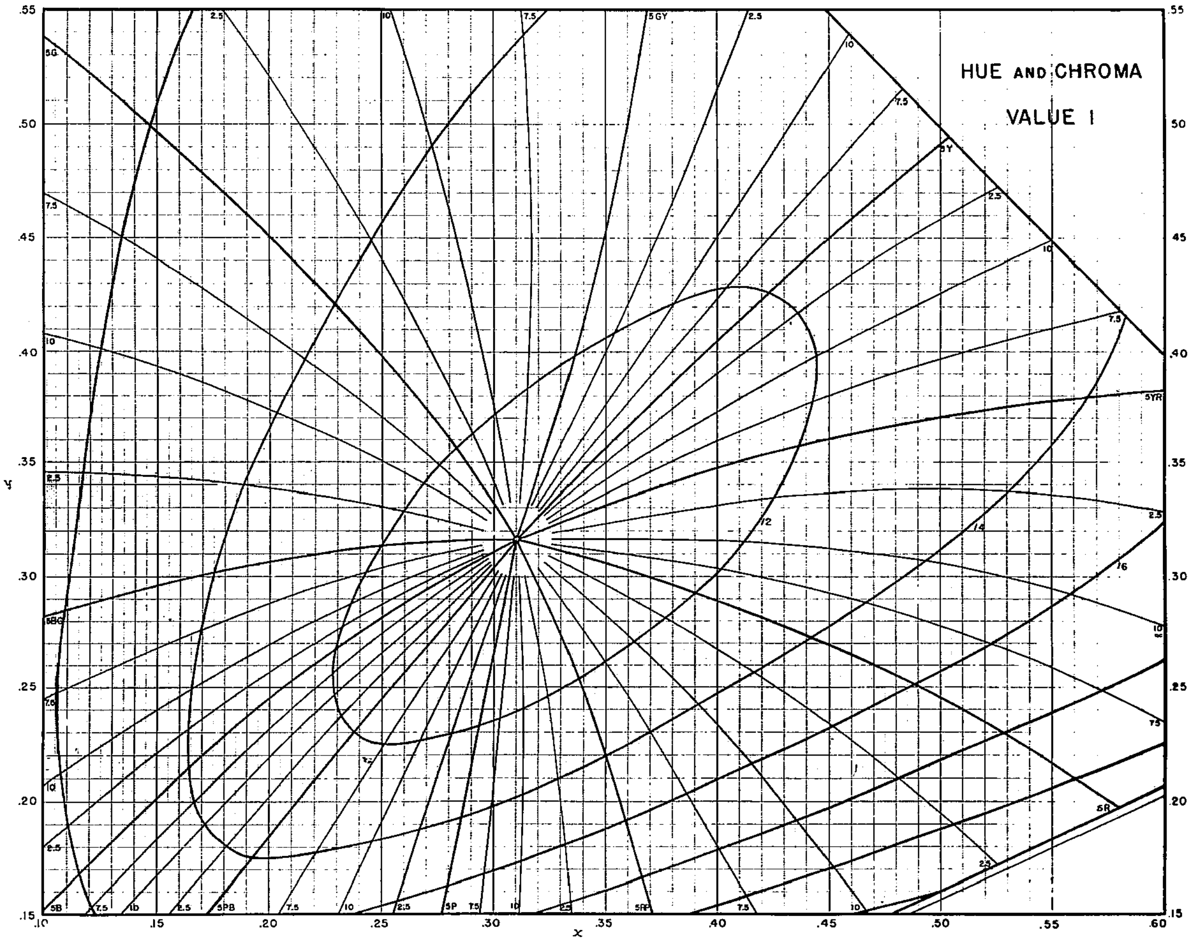

FIG. 3 Munsell Value 1—Loci of Constant Hue and Constant Chroma in CIE (x, y) Coordinates (2).

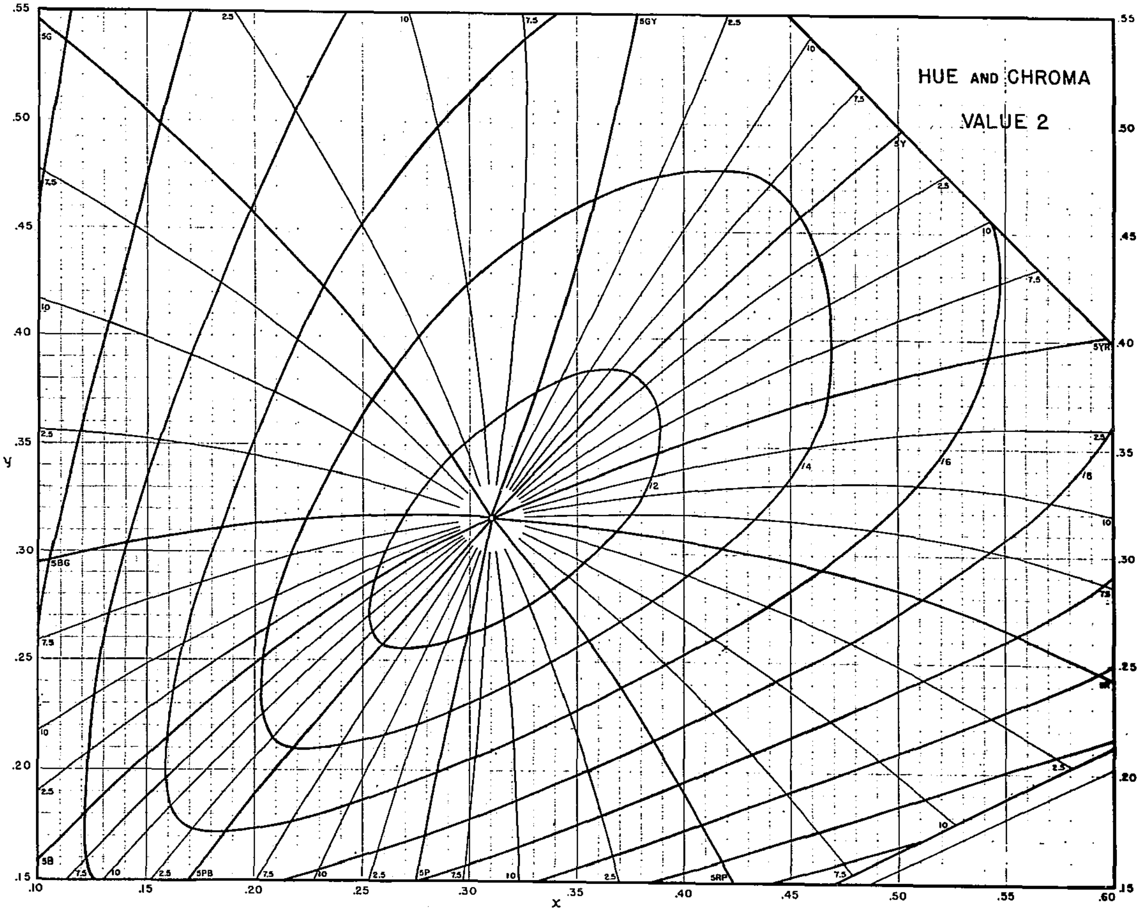

FIG. 4 Munsell Value 2—Loci of Constant Hue and Constant Chroma in CIE (x, y) Coordinates (2).

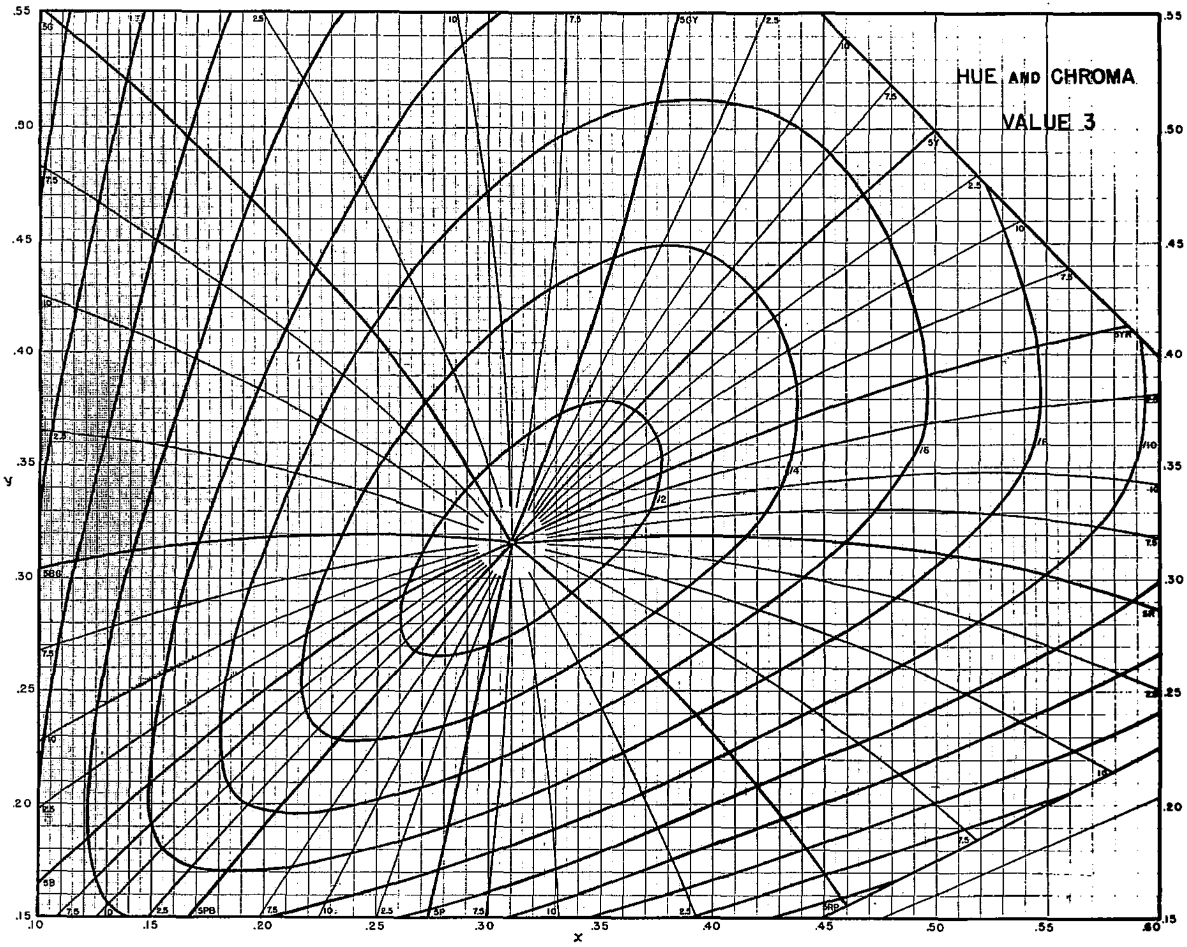

FIG. 5 Munsell Value 3—Loci of Constant Hue and Constant Chroma in CIE (x, y) Coordinates (2).

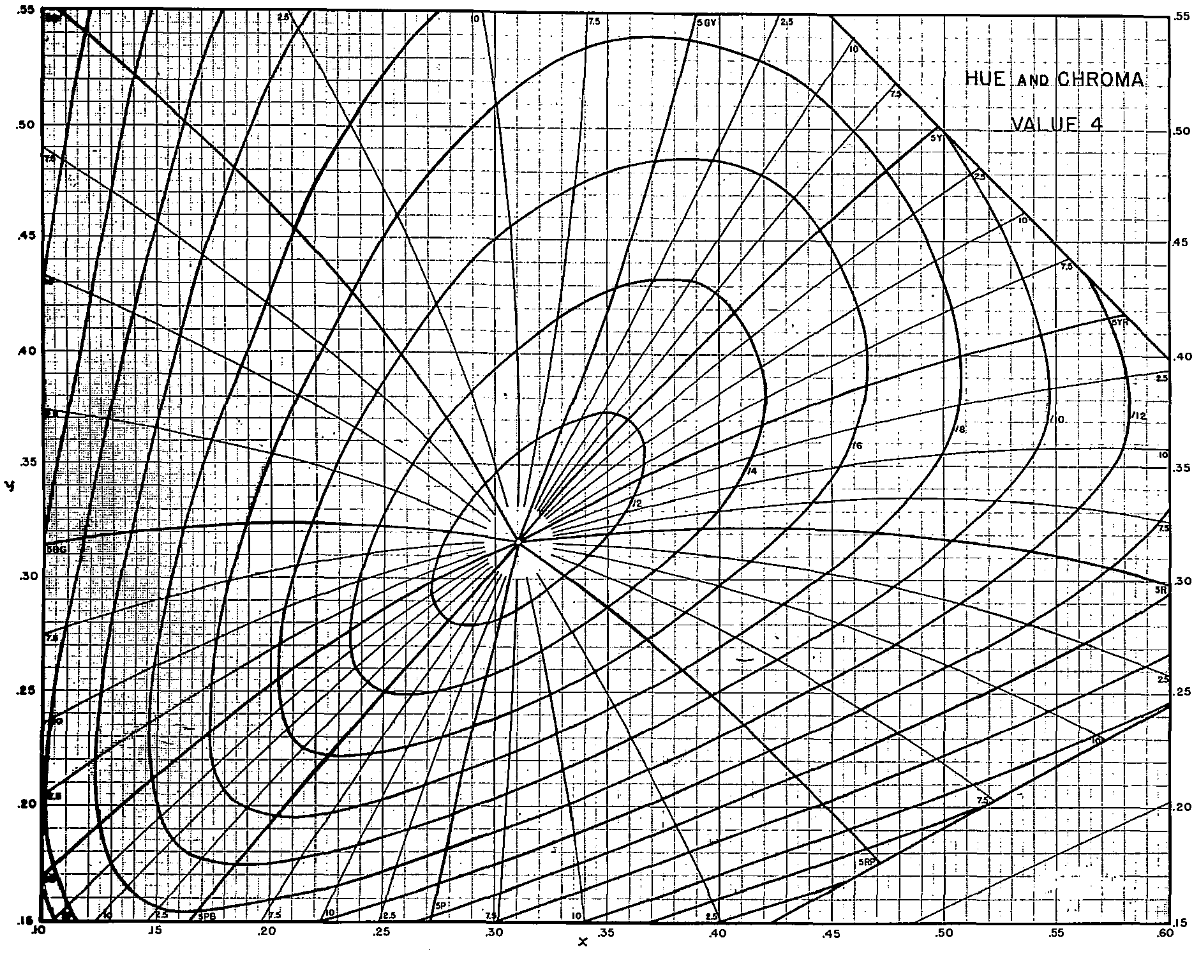

FIG. 6 Munsell Value 4—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

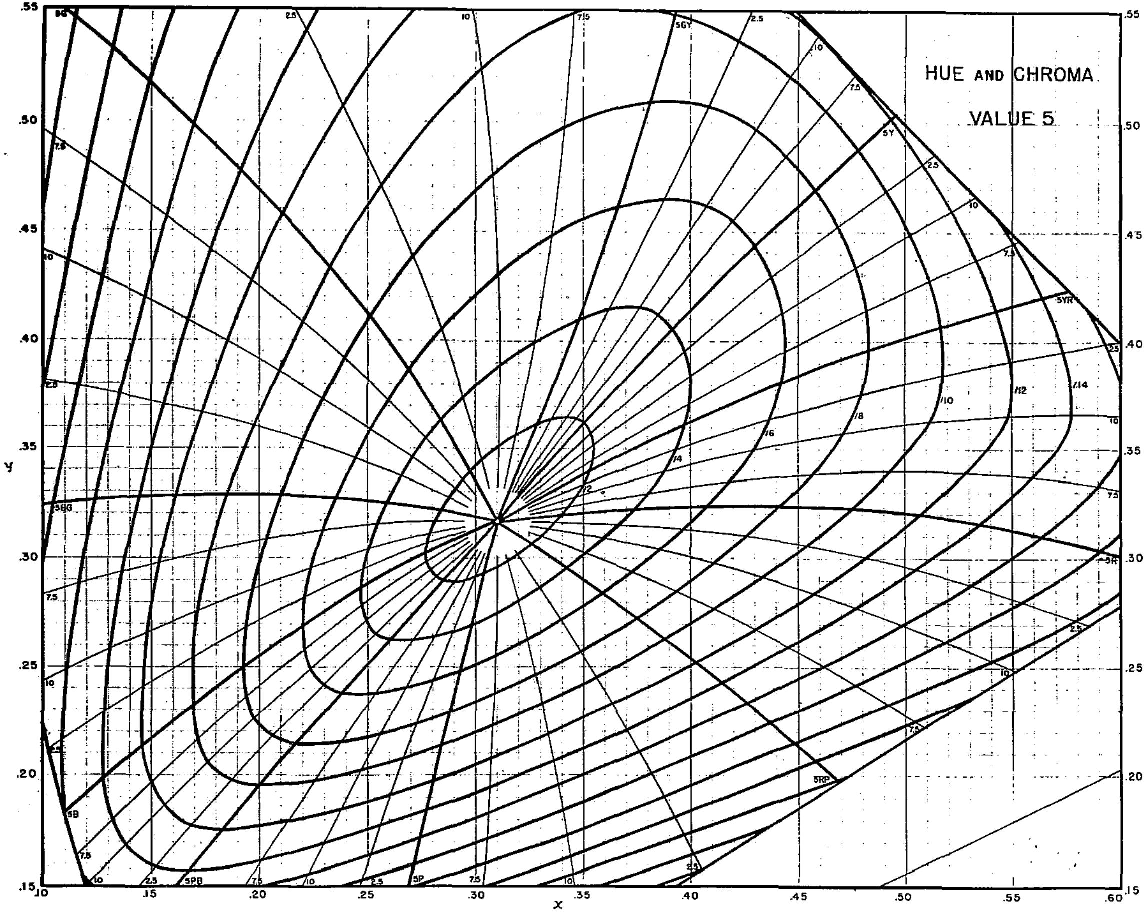

FIG. 7 Munsell Value 5—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

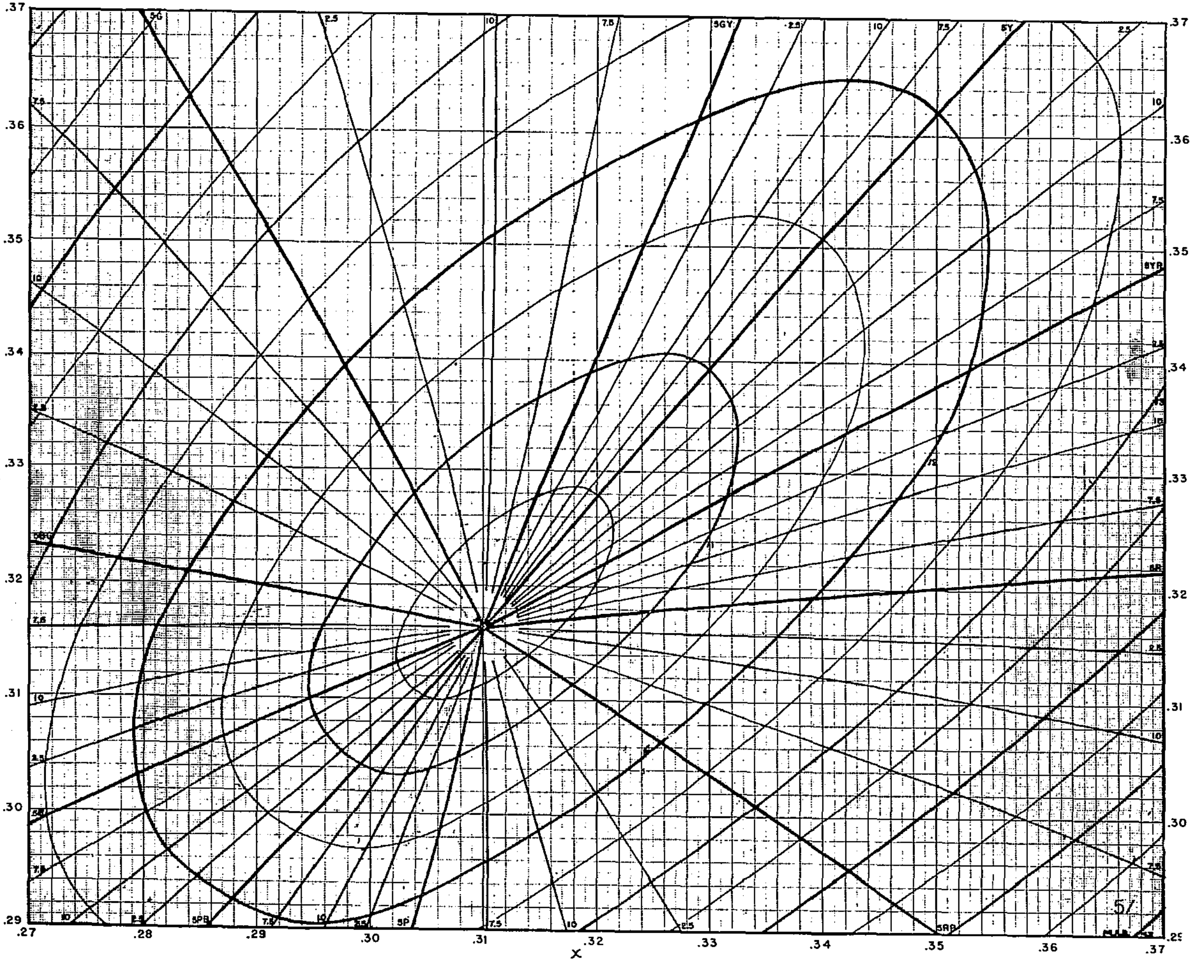

FIG. 8 Munsell Value 5—Loci of Constant Hue and Constant Chroma, Near Gray, in CIE (*x*, *y*) Coordinates (5).

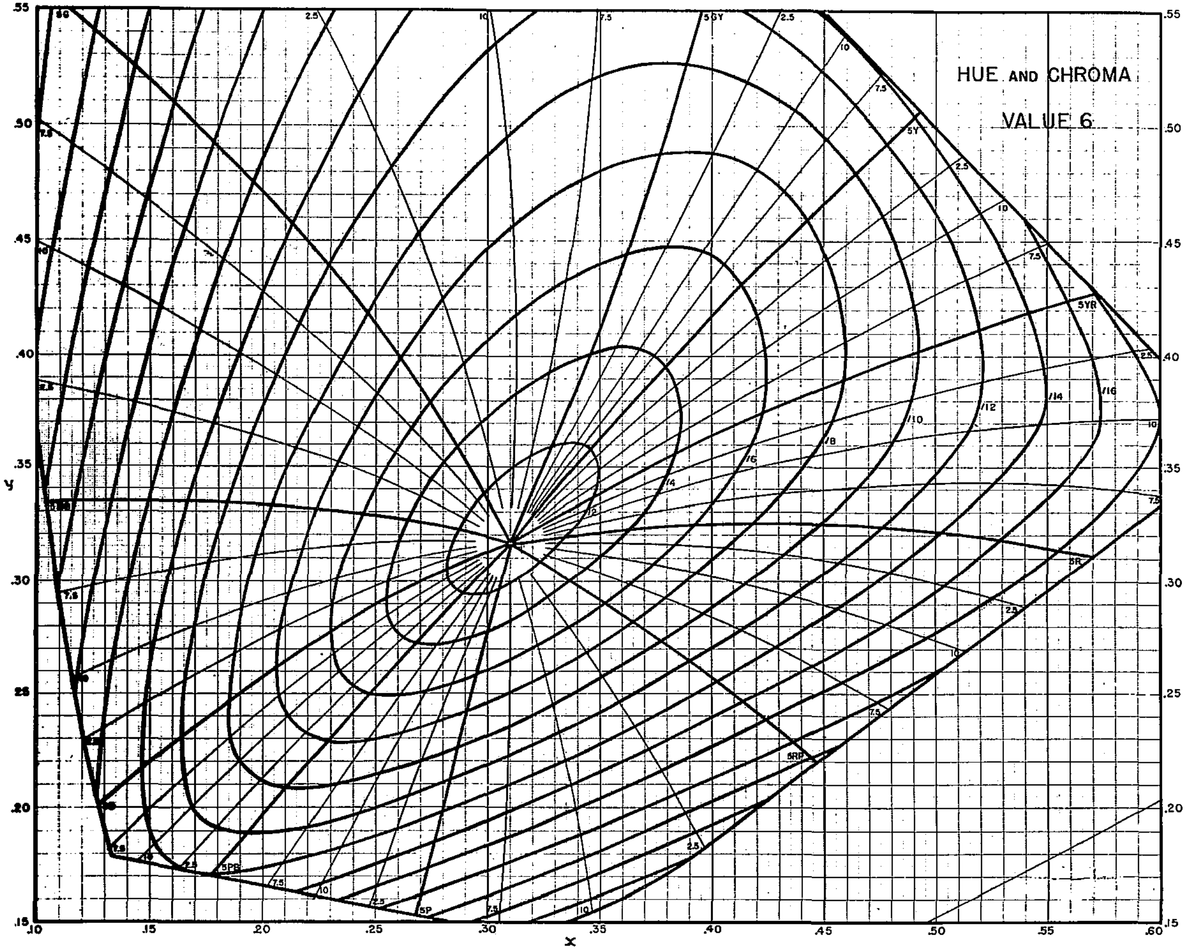

FIG. 9 Munsell Value 6—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

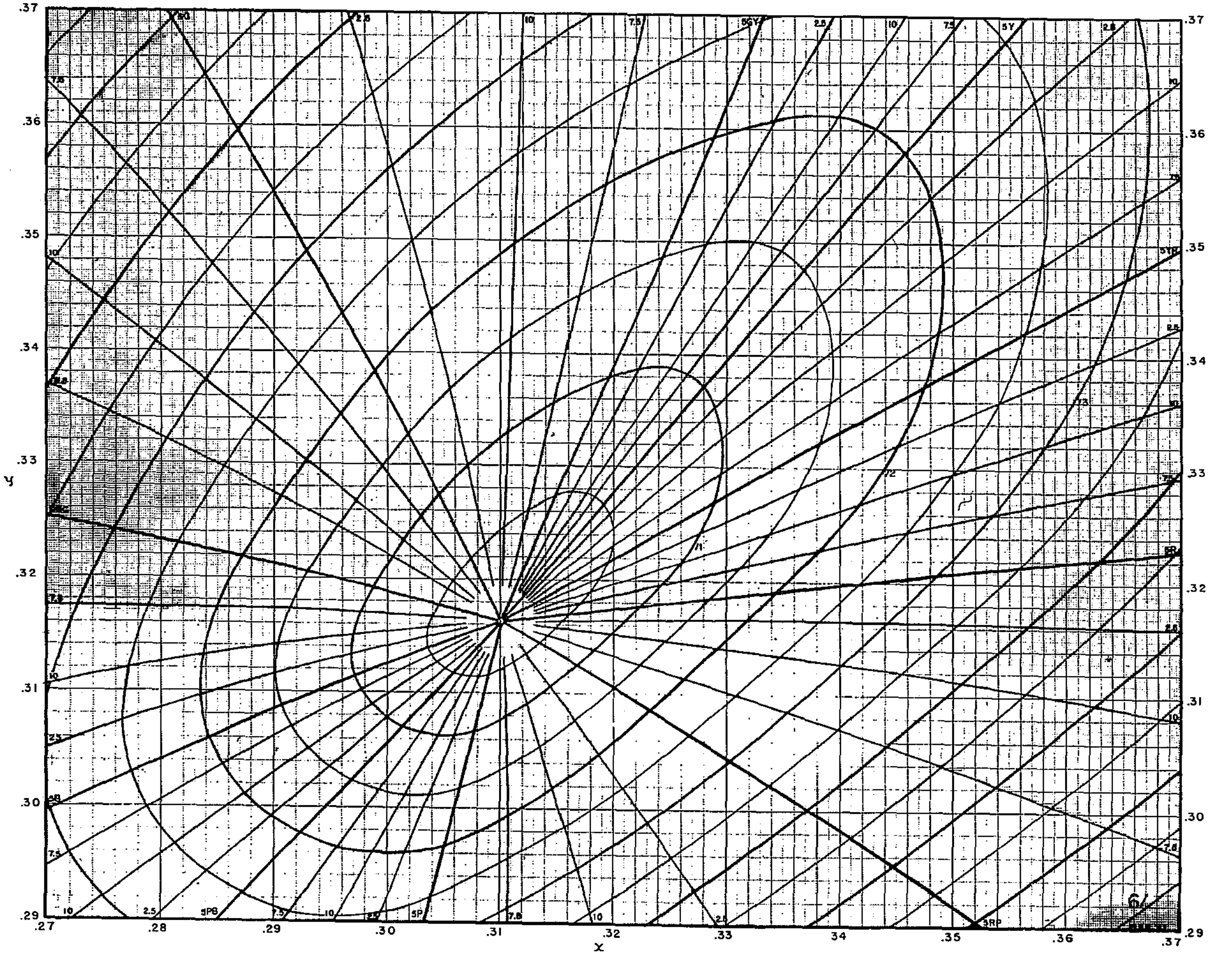

FIG. 10 Munsell Value 6—Loci of Constant Hue and Constant Chroma, Near Gray, in CIE (x, y) Coordinates (5).

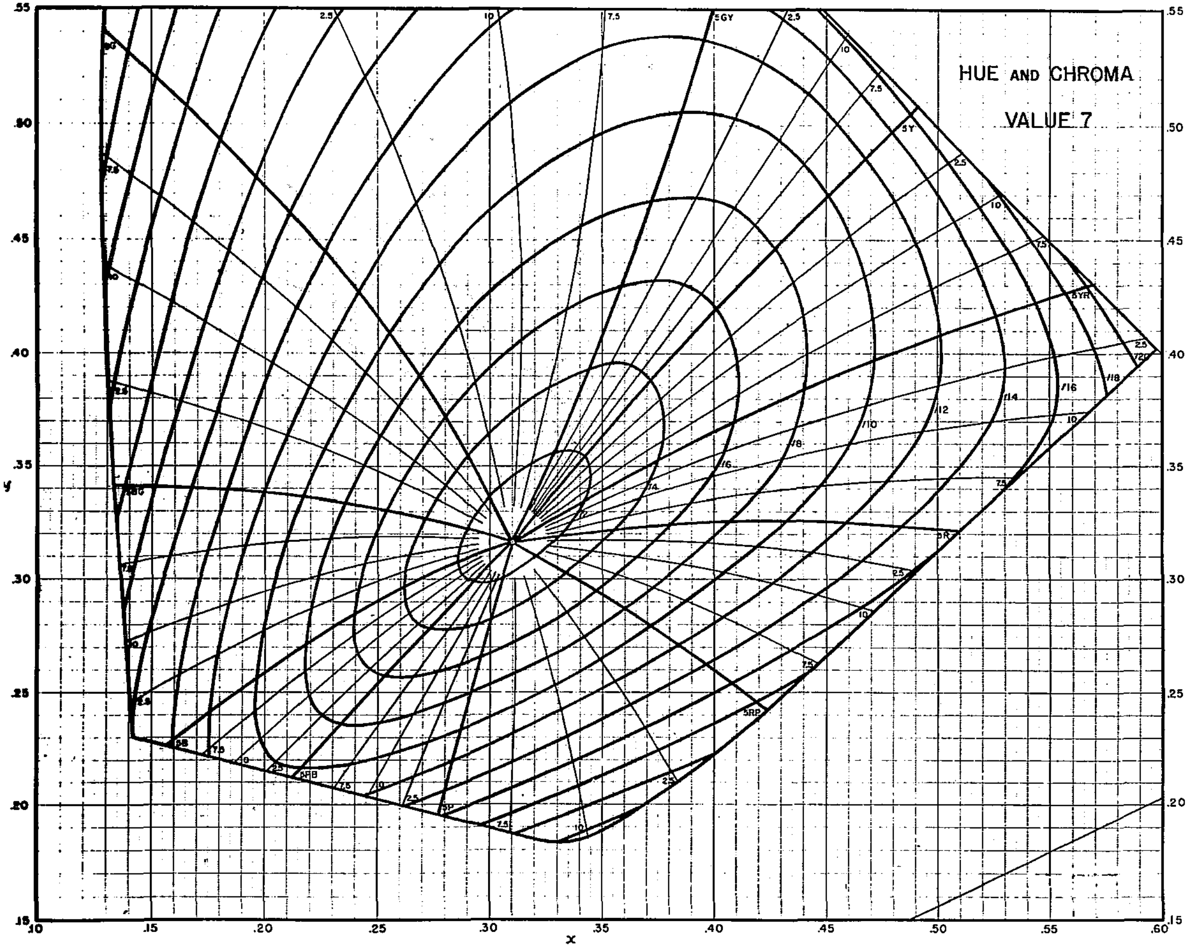

FIG. 11 Munsell Value 7—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

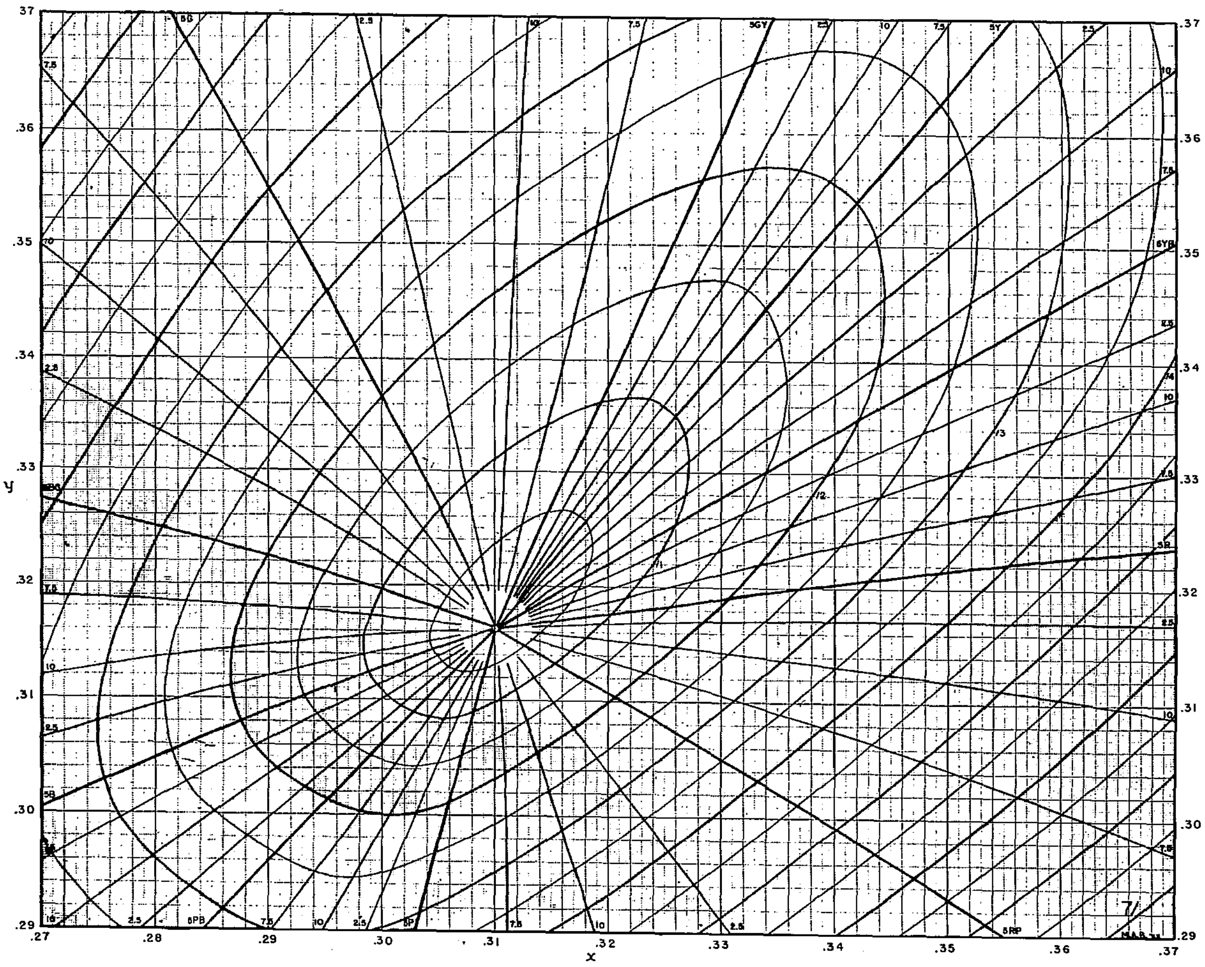

FIG. 12 Munsell Value 7—Loci of Constant Hue and Constant Chroma, Near Gray, in CIE (*x*, *y*) Coordinates (5).

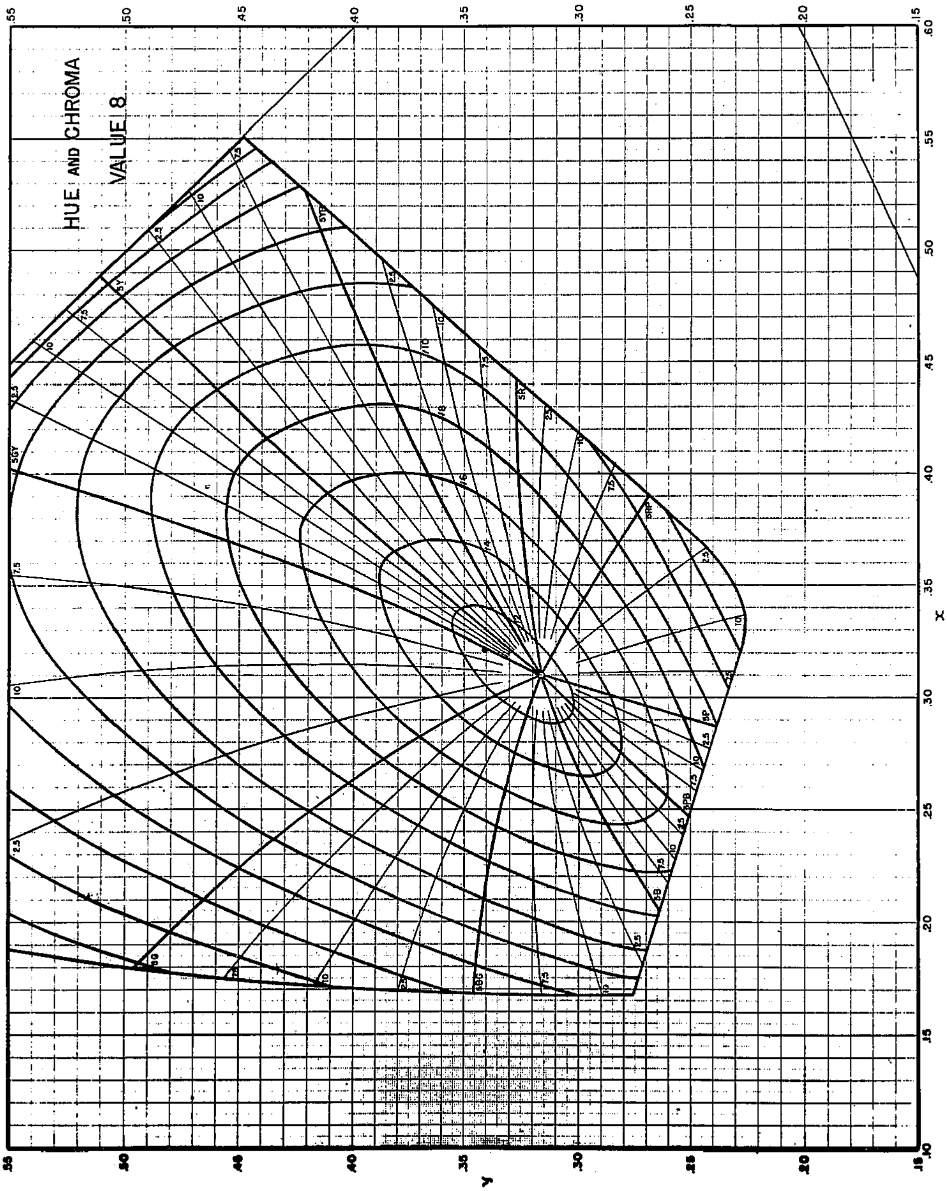

FIG. 13 Munsell Value 8—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

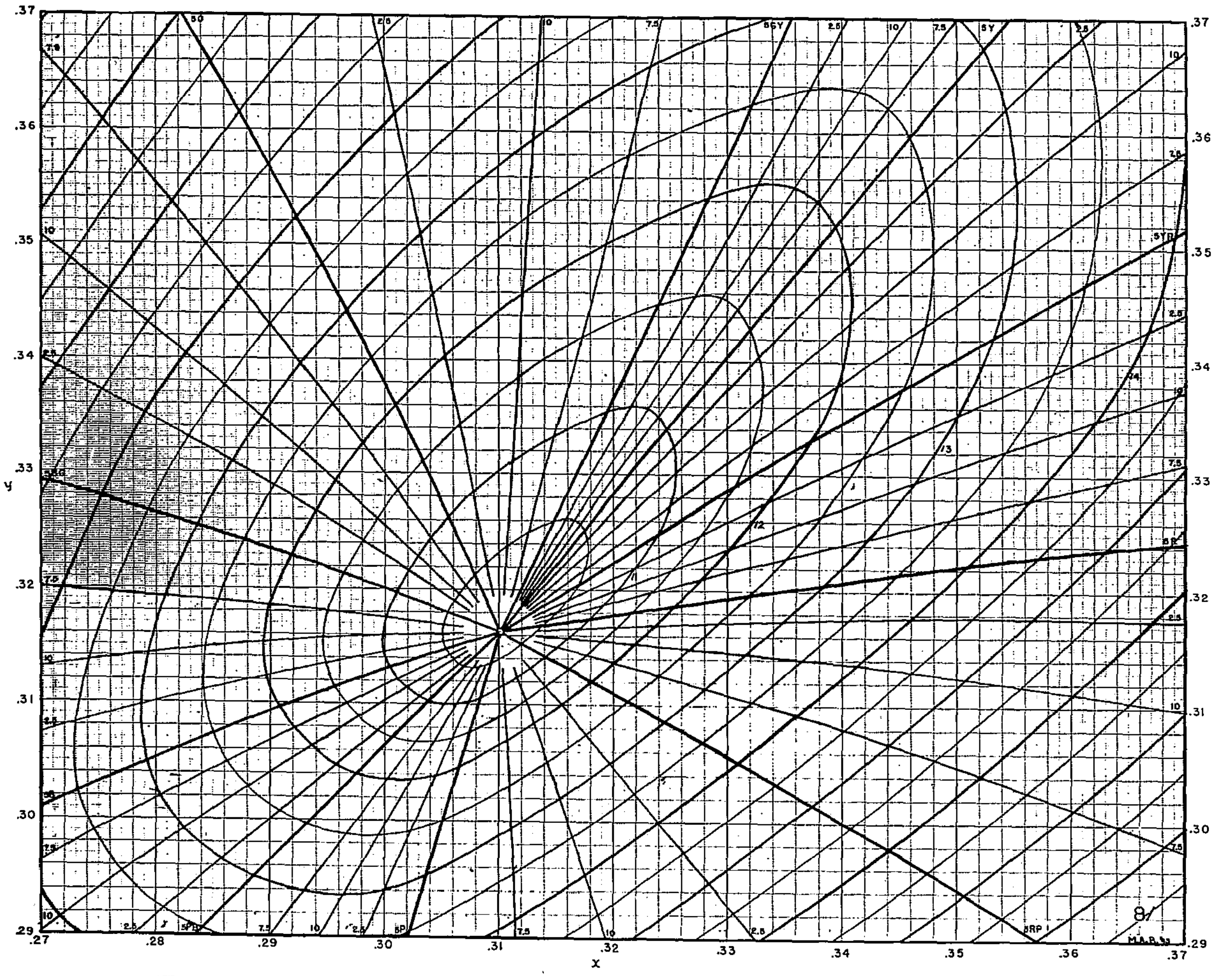

FIG. 14 Munsell Value 8—Loci of Constant Hue and Constant Chroma, Near White, in CIE (x, y) Coordinates (5).

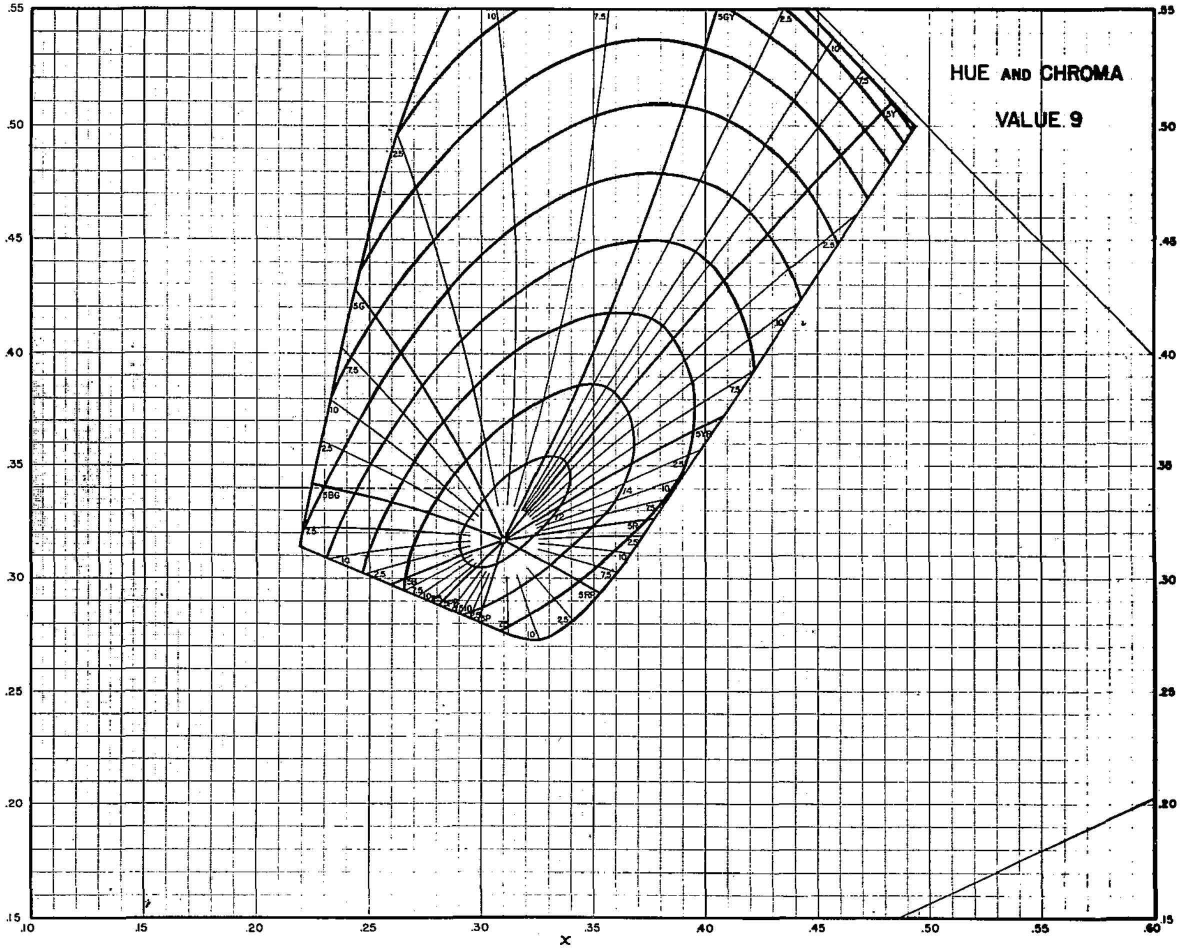

FIG. 15 Munsell Value 9—Loci of Constant Hue and Constant Chroma in CIE (*x*, *y*) Coordinates (2).

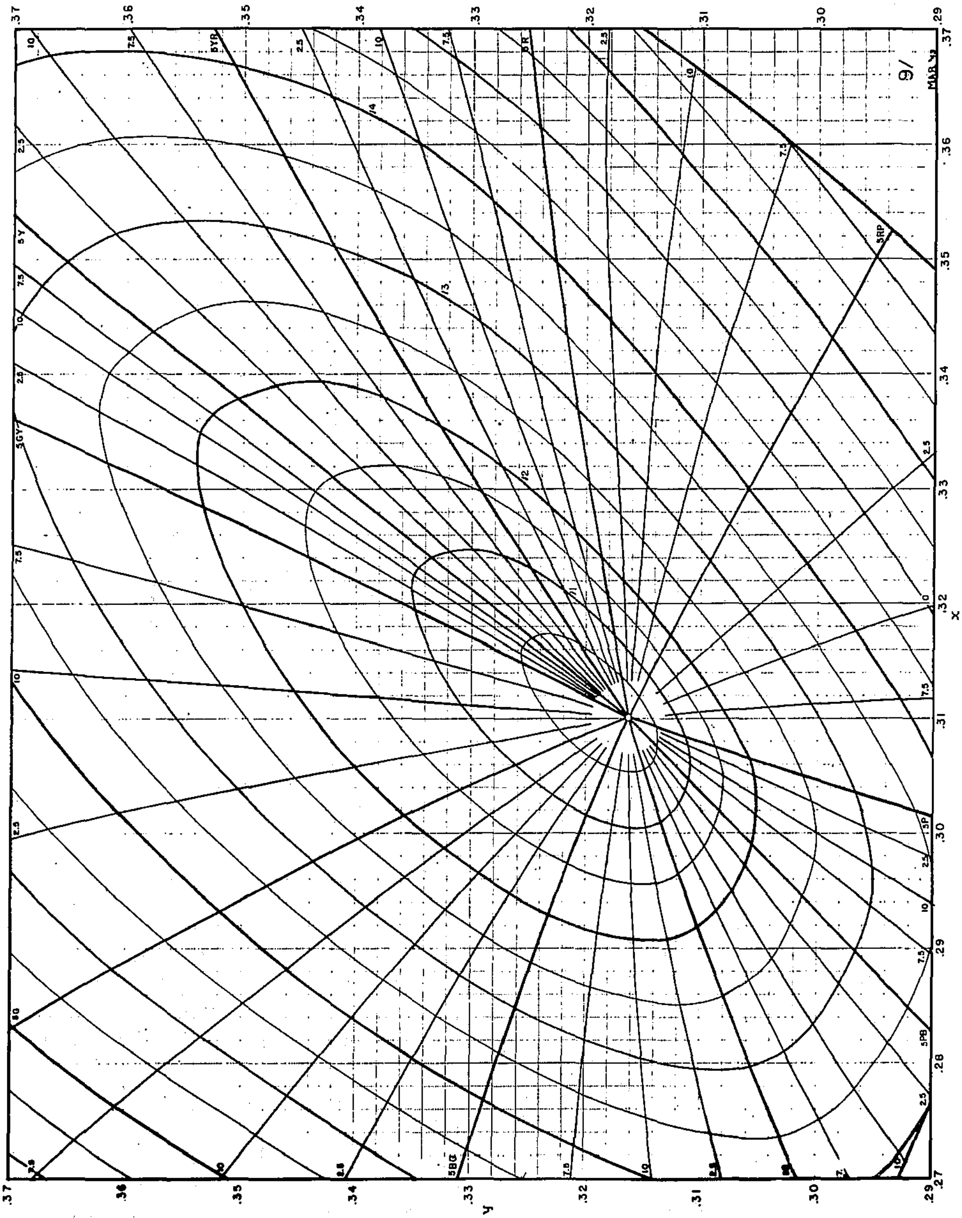

FIG. 16 Munsell Value 9—Loci of Constant Hue and Constant Chroma, Near White, in CIE (*x*, *y*) Coordinates (5).

By publication of this standard no position is taken with respect to the validity of any patent rights in connection therewith, and the American Society for Testing and Materials does not undertake to insure anyone utilizing the standard against liability for infringement of any Letters Patent nor assume any such liability.